REMARKS

This is in reply to the Final Office Action mailed on October 8, 2003, personal interview of November 25, 2003 and further to the Request for Continued Examination filed concurrently herewith.

Claims 1-7 are currently pending.

Claims 1-7 are rejected under 35 U.S.C. § 103(a) over Patent No. 6,517,723 ("Daigger") in view of Patent No. 5,914,040 ("Pescher").

Claim 1 is amended to particularly point out and distinctly claim subject matter which Applicants regard as their invention. Support for this amendment is found in the specification at page 9, lines 6-12 and 19-24.

No new matter is added by this amendment.

INTERVIEW SUMMARY

In a personal interview on November 25, 2003 attended by the Examiner and Applicants' representative Michael B. Martin, inventor John M. Collins and Membrane Bioreactor Project Manager Anders M. Hallsby Applicants discussed the Daigger and Pescher references and the current state of the art with regard to use of polymers in membrane filtration processes. The following points were discussed in detail.

Applicants explained that Daigger discloses in relevant part:

1. An apparatus for the removal of biological nutrients including phosphates and nitrogen from wastewater including a bioreactor containing a mixture of activated sludge and wastewater and an immersed membrane filter (col. 1, lines 16-19, col. 2, line 59 to col. 3, line 3);
2. An *Optional* treatment tank containing an immersed membrane filter where treated water from the bioreactor is treated with PAC (powdered activated carbon) in order to remove dissolved organics from the water (col. 3, lines 12-30); and
3. *Optional* addition of an unspecified coagulant to the treatment tank to aid in the removal of suspended solids, phosphorous or other substances (col. 3, lines 20-23 and col. 7, lines 14-16).

Applicants further explained that Pescher discloses a process for the purification of a medium containing animal waste in which effluent containing the organic waste is

1. treated with at least one oxidizing agent;
2. treated with at least one flocculating agent;
3. treated with at least one polyelectrolyte, including the instantly claimed coagulants;
4. subjected to a filtration stage whereby a filter cake and a filtrate are obtained; and
5. *optionally* filtering the filtrate through an ultrafiltration apparatus (Abstract and col. 5, lines 64-67).

Finally, Applicants discussed the current state of the art regarding use of coagulants in membrane separation processes including:

1. The two main classes of coagulants commonly used in water treatment:
   (i) Inorganic (ferric chloride, aluminum sulfate, etc); and
   (ii) Cationic polyelectrolytes as disclosed by Pescher among many others.

2. The use of inorganic coagulants in membrane filtration processes where they are known to not foul membranes. It was noted that inorganic coagulants effectively remove phosphorous from water. Applicants also pointed out that use of inorganic coagulants results in the generation of a large volume of sludge that must be disposed of as a result of the amount of inorganic coagulant that must be added to achieve the desired effect.

3. The fact that cationic polymer coagulants are not used in membrane filtration processes as they are known to contribute to membrane fouling. Accordingly, membrane manufactures and others specifically warn against use of cationic polyelectrolytes in membrane filtration processes. In cases where polymers are used in processes that incorporate filtration through a membrane at some point, there is always an intervening filtration step to remove polymer prior to contact of the treated water with a filtration membrane. It was also pointed out that cationic polyelectrolytes do not remove phosphorous from water.

In summary, Applicants asserted that:

1. Daigger does not teach or suggest:

- That the bioreactor and treatment tank can be combined into a single reactor.
- That PAC is not required in the combined reactor.
- That coagulant is required in all instances in the combined reactor.
- That the coagulant is a cationic polyelectrolyte coagulant rather than an inorganic coagulant.

2. Pescher does not teach or suggest:

- using a cationic polyelectrolyte in a membrane filtration process where the treated wastewater is not filtered prior to the membrane filtration.

3. Additional art teaches away from the instant invention:

- Cationic polyelectrolytes are known to foul membranes.
- In cases where polymers are used in water clarification processes that utilize membranes, a conventional filtration step always precedes contact of the treated water with the membrane so that no polymer is present in the water that contacts the membrane.

Applicants brought numerous references to the Examiner's attention in support of the above discussion regarding use of coagulants in membrane filtration processes.

Applicants also briefly discussed the history of the polymers in membrane bioreactors project and the unexpected discovery that contrary to fouling the filtration membranes, adding polymer to the bioreactor mixed liquor resulted in an increase in membrane flux of up to 1500%. It was also pointed out that this effect was observed at dosages of up to 30 times the effective dose. Data in support of the foregoing observations is presented in Tables 2-5 (Specification at pages 12-15.

It was agreed that Applicants would file a Request for Continued Examination, an IDS to make the new references of record and an amendment to recite that the "effective amount" of polymer referred to in Claim 1, step (i) is based on the amount of suspended solids in the bioreactor.

DISCUSSION

The Amendment to Claim 1

Applicants have amended claim 1, step (i) to insert "based on the amount of suspended solids in the bioreactor or measurement of the effectiveness of polymer dosage" after "effective dose". Support for this amendment is found in the specification at page 9, lines 6-12 and 19-24.

Applicants respectfully assert that the language that was not discussed with the examiner, particularly "or measurement of the effectiveness of polymer dosage" is included to recite an alternative, empirical method of determining the effective polymer dose that can be used in addition to or instead of basing the dosage on the amount of suspended solids present in the bioreactor. Support for this language is found in the specification at page 9, lines 19-24.

Applicants respectfully assert that this amendment is made for purposes of explaining determination of the effective polymer dose and does not limit the scope of original claim 1.

CONCLUSION

In view of the foregoing amendment and remarks, Applicants respectfully request withdrawal of the rejection of claims 1-7 under 35 U.S.C. § 103(a) over Daigger in view of Pescher and assert that this application is in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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